2000 P1 A1	**4C** $\bullet^1$ $\sin p \cos q + \cos p \sin q$ $\bullet^2$ 10 and 13 $\bullet^3$ $\frac{8}{10} \cdot \frac{12}{13} + \frac{6}{10} \cdot \frac{5}{13}$ $\bullet^4$ $\frac{126}{130}$ ans: $\frac{63}{65}$
02 P1 Q5	**4C** $\bullet^1$ $AC = \sqrt{2}$ and $BC = \sqrt{10}$ *stated or implied by* $\bullet^3$ $\bullet^2$ $\sin(a+b) = \sin a \cos b + \cos a \sin b$ $\bullet^3$ $\frac{1}{\sqrt{2}} \cdot \frac{3}{\sqrt{10}} + \frac{1}{\sqrt{2}} \cdot \frac{1}{\sqrt{10}}$ $\bullet^4$ $\frac{4}{\sqrt{20}} = \ldots\ldots = \frac{2}{\sqrt{5}}$
03 P1 Q10	**5C, 1B** $\bullet^1$ $\text{hypot} = \sqrt{80}$ $\bullet^2$ $\sin(p) = \frac{4}{\sqrt{80}}$ *and* $\cos(p) = \frac{8}{\sqrt{80}}$ $\bullet^3$ $\sin(2p) = 2\sin(p)\cos(p)$ $\bullet^4$ $\sin(2p) = \frac{4}{5}$ $\bullet^5$ $\cos(2p) = \frac{3}{5}$ $\bullet^6$ $\frac{4}{3}$
04 P1 Q10	**7B** $\bullet^1$ $D\hat{E}A = (2x^\circ + 90^\circ)$ $\bullet^2$ $\cos(2x^\circ)\cos(90^\circ) - \sin(2x^\circ)\sin(90^\circ)$ $\bullet^3$ $-\sin(2x^\circ)$ $\bullet^4$ $-2\sin(x^\circ)\cos(x^\circ)$ $\bullet^5$ $CE = \sqrt{1^2 + 3^2} = \sqrt{10}$ *stated* $\bullet^6$ $\sin(x^\circ) = \left(\frac{1}{\sqrt{10}}\right)$ *and* $\cos(x^\circ) = \frac{3}{\sqrt{10}}$ $\bullet^7$ $\cos D\hat{E}A = -2\left(\frac{1}{\sqrt{10}}\right)\left(\frac{3}{\sqrt{10}}\right) = -\frac{6}{10}$
05 P1 Q9	**4C** $\bullet^1$ $2\cos^2(x) - 1 = \frac{7}{25}$ $\bullet^2$ $\cos^2(x) = \frac{32}{50}$ $\bullet^3$ $\cos(x) = \frac{4}{5}$ $\bullet^4$ $\sin(x) = \frac{3}{5}$ **OR** $\bullet^1$ $1 - 2\sin^2(x) = \frac{7}{25}$ $\bullet^2$ $\sin^2(x) = \frac{18}{50}$ $\bullet^3$ $\sin(x) = \frac{3}{5}$ $\bullet^4$ $\cos(x) = \frac{4}{5}$
05 P2 Q2	**4C, 3C** $\bullet^1$ $\cos(p) = \frac{8}{17}, \sin(p) = \frac{15}{17}$ $\bullet^2$ $\cos(q) = \frac{8}{10}, \sin(q) = \frac{6}{10}$ $\bullet^3$ $\sin(p)\cos(q) + \cos(p)\sin(q)$ $\bullet^4$ $\frac{15}{17} \times \frac{8}{10} + \frac{8}{17} \times \frac{6}{10} =$ *& complete*

	•[5] $\cos(p)\cos(q)-\sin(p)\sin(q)$ •[6] $-\frac{13}{85}$ *or equivalent fraction* •[7] $-\frac{84}{13}$ *or equivalent fraction* $\left(eg\ -\frac{7140}{1105}\right)$
06 P2 Q8	**4C, 4B** •[1] $\sin(a°)=\frac{1}{\sqrt{5}}$ •[2] $\sin(2a°)=2\sin(a°)\cos(a°)$ •[3] $\cos(a°)=\frac{2}{\sqrt{5}}$ •[4] $\sin(2a°)=\frac{4}{5}$ •[5] $\sin(3a°)=\sin(2a°)\cos(a°)+\cos(2a°)\sin(a°)$ •[6] $\cos(2a°)=\frac{3}{5}$ •[7] $\sin(3a°)=\frac{4}{5}.\frac{2}{\sqrt{5}}+\frac{3}{5}.\frac{1}{\sqrt{5}}$ •[8] $\sin(3a°)=\frac{11}{5\sqrt{5}}$
07 P2 Q2	**4C, 4C** •[1] $\sqrt{5}$ *and* $\sqrt{10}$ s/i by •[3] •[2] $\sin(c)\cos(d)+\cos(c)\sin(d)$ s/i by •[3] •[3] $\frac{1}{\sqrt{5}}\times\frac{3}{\sqrt{10}}+\frac{2}{\sqrt{5}}\times\frac{1}{\sqrt{10}}$ •[4] $\frac{1}{\sqrt{2}}$ (accept any equivalent single fraction) •[5] $2\sin(c)\cos(c)$ •[6] $2\times\frac{1}{\sqrt{5}}\times\frac{2}{\sqrt{5}}=\frac{4}{5}$ *or equivalent* •[7] *e.g.* $\cos^2(d)-\sin^2(d)$ •[8] $\frac{9}{10}-\frac{1}{10}=\frac{8}{10}=\frac{4}{5}$
09 P1 Q24	**3C, 2C, 4C/B**

	•[1] $\sin\frac{\pi}{3}\cos\frac{\pi}{4}+\cos\frac{\pi}{3}\sin\frac{\pi}{4}$ s / i by •[2] •[2] $\frac{\sqrt{3}}{2}\times\frac{1}{\sqrt{2}}+\frac{1}{2}\times\frac{1}{\sqrt{2}}$ •[3] $\frac{\sqrt{3}+1}{2\sqrt{2}}$ *or equivalent* •[4] $\sin A\cos B+\cos A\sin B+\ldots$ •[5] $\ldots\ldots+\sin A\cos B-\cos A\sin B$ and complete •[6] $\frac{\pi}{12}=\frac{\pi}{3}-\frac{\pi}{4}$ stated explicitly *and* A *is* $\frac{\pi}{3}$, B *is* $\frac{\pi}{4}$ s / i by •[7] •[7] $2\sin\frac{\pi}{3}\cos\frac{\pi}{4}$ •[8] $2\times\frac{\sqrt{3}}{2}\times\frac{1}{\sqrt{2}}$ •[9] $\frac{\sqrt{6}}{2}$ $\left(\text{accept } \sqrt{\frac{3}{2}} \text{ or } \frac{\sqrt{3}}{\sqrt{2}} \text{ but not } \frac{2\sqrt{3}}{2\sqrt{2}}\right)$	**Alternatives** 1. for •[6] to •[8] •[6] $\sin\left(\frac{\pi}{12}\right)=\sin\frac{\pi}{3}\cos\frac{\pi}{4}-\cos\frac{\pi}{3}\sin\frac{\pi}{4}$ •[7] $\frac{\sqrt{3}}{2}\times\frac{1}{\sqrt{2}}-\frac{1}{2}\times\frac{1}{\sqrt{2}}$ •[8] $\frac{\sqrt{3}-1}{2\sqrt{2}}$ *or equivalent*

10 P1 Q23	write in slope/intercept form	•[1] $y=\frac{3}{2}x$ or $y=1\cdot5x$	*stated explicitly*
	connect gradient and $\tan a$	•[2] $m=\frac{3}{2}$ and $\tan a=\frac{3}{2}$ **or** $m=\tan a$ and $\tan a=\frac{3}{2}$	
	calculate hypotenuse	•[3] $\sqrt{13}$	*stated, or implied by* •[4]
	state value of sine ratio	•[4] $\frac{3}{\sqrt{13}}$ or $\frac{3\sqrt{13}}{13}$	*may not appear until* (c)
	determine $\tan b$	•[5] $\tan b=\frac{3}{4}$	*stated, or implied by* •[6]
	know to complete triangle	•[6] right angled triangle with 3 and 4 correctly shown	
	determine hypotenuse	•[7] 5	*stated, or implied by* •[8]
	state values of sine and cos	•[8] $\sin b=\frac{3}{5}$ and $\cos b=\frac{4}{5}$	*may not appear until* (c)
	know to use addition formula	•[9] $\sin a\cos b-\cos a\sin b$	
	substitute into expansion	•[10] $\frac{3}{\sqrt{13}}\times\frac{4}{5}-\frac{2}{\sqrt{13}}\times\frac{3}{5}$	
	evaluate sine of compound angle	•[11] $\frac{6}{5\sqrt{13}}$	
	use $\sin(-x)=-\sin x$	•[12] $-\frac{6}{5\sqrt{13}}$	

PRE 2000 ANSWERS – **Trig Formulae**

1	•[1] $\sin A=\frac{3}{5}$ and $\cos A=\frac{4}{5}$ •[2] $\sin 2A=2\times\frac{3}{5}\times\frac{4}{5}=\frac{24}{25}$ (*accept* 0.96) •[3] $\cos 2A=$ *e.g.* $\left(\frac{4}{5}\right)^2-\left(\frac{3}{5}\right)^2=\frac{7}{25}$ (*accept* 0.28)	•[4] $\sin 2A\cos B+\cos 2A\sin B$ •[5] $\sin B=\frac{5}{13}$ *and* $\cos B=\frac{12}{13}$ *and* $\frac{323}{325}$

2	•[1] $\sin x^\circ \cos 30^\circ + \cos x^\circ \sin 30^\circ$ •[2] $\sin x^\circ = \frac{4}{5}$ & $\cos x^\circ = \frac{3}{5}$ •[3] $\frac{4}{5}.\frac{\sqrt{3}}{2}+\frac{3}{5}.\frac{1}{2}$ and completes proof
3	•[1] know to calculate missing sides •[2] $\text{BD}=5,\ \text{AD}=\sqrt{24}$ •[3] $\cos x \cos y - \sin x \sin y = \frac{4}{5}.\frac{5}{7}-\frac{3}{5}.\frac{\sqrt{24}}{7}$
4	•[1] sketch with $\frac{x}{2}$ marked in r / a Δ •[2] height of triangle $=\sqrt{5}$ •[3] $\sin x = 2\sin\frac{1}{2}x\cos\frac{1}{2}x$ •[4] $\sin\frac{x}{2}=\frac{2}{3}$ *and* $\cos\frac{1}{2}x=\frac{\sqrt{5}}{3}$ •[5] $\sin x = \frac{4\sqrt{5}}{9}$ ***OR*** •[1] know to use cosine rule •[2] $\cos x = \frac{3^2+3^2-4^2}{2.3.3}$ •[3] $\frac{1}{9}$ •[4] draw r / a Δ *or* use $\cos^2 x + \sin^2 x = 1$ •[5] $\sin x = \frac{\sqrt{80}}{9}$
5	•[1] "third side" $=\sqrt{20}$ •[2] $\sin\alpha = \frac{\sqrt{11}}{\sqrt{20}}$ *or* $\cos\alpha = \frac{3}{\sqrt{20}}$ •[3] $2\times\frac{\sqrt{11}}{\sqrt{20}}\times\frac{3}{\sqrt{20}}$
6	•[1] $\sin\theta\cos 120+\cos\theta\sin 120$ **and** $\cos\theta\cos 150-\sin\theta\sin 150$ •[2] correct use of exact values •[3] simplification to zero
7	•[1] $\sin\theta = \frac{3}{5}$ •[2] $\frac{24}{25}$ •[3] $2\sin 2\theta\cos 2\theta$ •[4] $\cos 2\theta = \frac{7}{25}$ •[5] $\frac{336}{625}$
8	•[1] $\cos P = \frac{5}{13}$ •[2] $\cos Q = \frac{4}{5}$ •[3] $\frac{12}{13}\times\frac{4}{5}+\frac{5}{13}\times\frac{3}{5}$
9	•[1] *strat for* cos: *eg* $\cos^2 = 1-\sin^2$ •[2] $\cos A = \frac{\sqrt{7}}{4}$ •[3] $\sin 2A = \frac{3\sqrt{7}}{8}$
10	•[1] *strat for exact value: e.g.* $\sin^2 D = 1-\cos^2 D$ •[2] $\sin D = \frac{1}{\sqrt{5}}$ •[3] $\cos 2D = \frac{3}{5}$
11	•[1] $OA = OB = \sqrt{a^2+b^2}$ •[2] $\sin A\hat{O}B = \sin\left(B\hat{O}x - A\hat{O}x\right) = \sin B\hat{O}x\cos A\hat{O}x - \cos B\hat{O}x\sin A\hat{O}x$ •[3] $\frac{a}{\sqrt{a^2+b^2}}.\frac{a}{\sqrt{a^2+b^2}}-\frac{b}{\sqrt{a^2+b^2}}.\frac{b}{\sqrt{a^2+b^2}}$ •[4] $\frac{a^2-b^2}{a^2+b^2}$

12	$\bullet^1$ $\cos x = \frac{2}{\sqrt{11}}$ *or* $\sin x = \frac{\sqrt{7}}{\sqrt{11}}$ $\bullet^2$ $\cos 2x = 2\times\left(\frac{2}{\sqrt{11}}\right)^2 - 1$ $\bullet^3$ $-\frac{3}{11}$
13	(*a*) $\bullet^1$ proof e.g. showing rt - angled triangle with "1" and a° (*b*) $\bullet^2$ Q is $(\cos(a-45)°, \sin(a-45)°)$ (*c*) $\bullet^3$ R is $(\cos(a+45)°, \sin(a+45)°)$ (*d*) $\bullet^4$ $\frac{\sin(a+45)-\sin(a-45)}{\cos(a+45)-\cos(a-45)}$ $\bullet^5$ $\frac{\sin a\cos 45+\cos a\sin 45-\sin a\cos 45+\cos a\sin 45}{\cos a\cos 45-\sin a\sin 45-\cos a\cos 45-\sin a\sin 45}$ $\bullet^6$ $\frac{2\cos a\sin 45}{-2\sin a\sin 45}$ $\bullet^7$ $-\frac{1}{\tan a}$ (*e*) $\bullet^8$ $m_{OP} = \frac{\sin a}{\cos a} = \tan a$ $\bullet^9$ $m_{tgt\ at\ P} = -\frac{1}{\tan a}$
14	(*a*) $\bullet^1$ $CA = \frac{d}{\tan a}$ $\bullet^2$ $CB = \frac{d}{\tan(180-b)}$ (*b*) $\bullet^3$ $AB = \frac{d}{\frac{\sin a}{\cos a}} - \frac{d}{\frac{\sin b}{\cos b}}$ $\bullet^4$ $\frac{d\cos a}{\sin a} - \frac{d\cos b}{\sin b}$ $\bullet^5$ $\frac{d\sin b\cos a - d\cos b\sin a}{\sin a\sin b}$ (*c*) $\bullet^6$ AB = 14 $\bullet^7$ 1.577 or 0.634 (comes from AB = 1.577d or d = 0.634 AB) $\bullet^8$ 8.9 miles